

*Synthetic layer
+ metal layer*

PATENT ABSTRACTS OF JAPAN

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(54) PRODUCTION OF ANTISTATIC WATER-REPELLENT KNITTED FABRIC

(57)Abstract:

PURPOSE: To obtain antistatic water-repellent knitted fabric having excellent appearance and improved water-repellent performance.

CONSTITUTION: Yarn (yarn A in short) comprising non-conductive synthetic yarn having <5 denier fineness and $\leq 15\%$ shrinkage percentage in hot water is prepared. On the other hand, yarn comprising electrically-conductive yarn (yarn B in short) having <15 denier fineness and $\leq 10\%$ shrinkage percentage in hot water is prepared. Both the yarns are used and knitted by plaiting knitting in such a way that the yarn A is positioned on the surface side and the yarn B is placed on the back side. In the knitting, the weight ratio of the yarn A is 60.0-99.8wt.% and that of the yarn B is 0.2-40.0wt.%. The prepared knitted fabric, for example, is dyed and processed and provided with a water repellent. Since gray or black electrically-conductive yarn is arranged inside the yarn A, appearance on the surface of the prepared knitted fabric is hardly damaged and the surface of the knitted fabric is uniformly provided with the water repellent. The knitted yarn can be semipermanently provided with antistatic properties.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the manufacture method of the antielectricity characteristic hydrofuge knitting fabric which has a good antielectricity characteristic and good water repellence simulataneously especially about the manufacture method of the antielectricity characteristic hydrofuge knitting fabric which can be suitably used as the object for garments, or an object for garments materials.

[0002]

[Description of the Prior Art] The electrostatic disagreeable damage by friction between fiber tends to produce the knitting fabric by which the volume on ** was carried out using the synthetic fiber. For this reason, the method of giving an antistatic agent at the time of dyeing and finishing of knitting fabric is used regularly. However, if the antistatic effect by this method is not eternal, the degradation is caused and about 30 repeat wash is generally repeatedly carried out by wash, the antistatic agent adhering to fiber will be omitted, and the antistatic effect will disappear. On the other hand, in order to give water repellence to the knitting fabric using the synthetic fiber, giving water repellents, such as a fluorine system and a silicone system, to knitting fabric, and carrying out dryness heat treatment like the last fitter in a dyeing-and-finishing process, generally, is performed.

[0003] Thus, generally the antistatic finish and water repellent finishing of the so-called post-processing article which are performed at a dyeing-and-finishing process usually being independently performed respectively according to the purpose, performing both simultaneously, and making antistatic nature (antielectricity characteristic) and water repellence have simulataneously is not performed. This is because this hygroscopicity will fall if the hygroscopicity on the front face of knitting fabric must be good and performs water repellent finishing, in order to heighten the effect of antistatic nature. The knitting fabric which made an antielectricity characteristic and water repellence have simulataneously has come [namely,] to be put in practical use by using an antistatic agent and a water repellent.

[0004] For this reason, without using an antistatic agent, conductive fiber is used and the method of giving a water repellent to the knitting fabric which carried out little mixing of this at a dyeing-and-finishing process is proposed. According to this method, it is thought that the knitting fabric which has simulataneously a highly efficient antielectricity characteristic and highly efficient water repellence is obtained. It is because it is not called defluxion of the antistatic agent by repeat wash and a highly efficient antielectricity characteristic can be demonstrated, since it replaces with an antistatic agent and conductive fiber is used. Moreover, it is because a good antielectricity characteristic is demonstrated regardless of the character on the front face of knitting fabric even if a knitting fabric front face is water repellence, since conductive fiber is used.

[0005] However, gray or since it was coloring black, when conductive fiber generally scoured the carbon particle and the carbon black particle in fiber, and it interwove with other fiber or they carried out the volume on intersection to other lines of thread, the pattern of the shape of **** and a ** tone appeared in knitting fabric by own coloring of conductive fiber, and it had the fault of spoiling

appearance. Moreover, it might be said that it tends to drop out even if adhesion of the water repellent to conductive fiber cannot adhere easily or adheres compared with adhesion of the water repellent to other general synthetic fibers. Therefore, the water repellence on the front face of knitting fabric became uneven, and there was also a fault of having covered the whole and being hard to realize good water repellence. Furthermore, rather than the synthetic fiber generally used, since the fineness of conductive fiber was *****, when it interwove with the synthetic fiber or the volume on intersection was carried out to the synthetic-fiber line of thread, it also had the fault that the hand of the knitting fabric obtained fell.

[0006]

[Problem(s) to be Solved by the Invention] Then, by using for this invention the line of thread which consists of a non-conducting synthetic fiber currently generally used, and the line of thread which consists of conductive fiber, and composing knitting fabric by the volume on **** While preventing that make it the line of thread which consists of conductive fiber located inside a stitch, prevent and have that conductive fiber is exposed to a knitting fabric front face, and appearance is spoiled by coloring of conductive fiber While preventing the adhesive fall of the water repellent in a knitting fabric front face and preventing the fall of the hand on the front face of knitting fabric further, the knitting fabric which has simulatananeously a highly efficient water-repellent and highly efficient antielectricity characteristic will be offered.

[0007]

[Means for Solving the Problem] That is, this invention is a line of thread (it is hereafter called "A line of thread".) which fineness is less than 5 deniers, and a hot water contraction becomes from 15% or less of non-conducting synthetic fiber. The line of thread which a hot water contraction becomes [fineness] from 10% or less of conductive fiber by less than 15 deniers (it is hereafter called "B line of thread".) Use, and make it A line of thread located in a side front, and it is made to make it B line of thread located in a background by the volume on ****. And the weight rate of A line of thread is related with the manufacture method of the antielectricity characteristic hydrofuge knitting fabric characterized by carrying out and giving a water repellent to the obtained knitting fabric the volume on **, as the weight rate of B line of thread becomes 0.2 - 40.0 % of the weight at 60.0 - 99.8 % of the weight.

[0008] A line of thread used by this invention is a line of thread which a hot water contraction becomes from 15% or less of non-conducting synthetic fiber with the fineness of less than 5 deniers. As a non-conducting synthetic fiber, the polyester fiber and polyamide fiber which are generally used, a polyolefin fiber, poly bitter taste RIRONITORU fiber, etc. are conventionally used for garments. That is, the non-conducting synthetic fiber said by this invention does not pass to what is used in order to distinguish from the conductive fiber which is another fiber, but it means the thing of the synthetic fiber regularly used as an object for garments etc. from the former. Moreover, as a line of thread, a multifilament line of thread, a spinning line of thread, etc. are used. Although a well-known gestalt is conventionally used especially as a gestalt of a multifilament line of thread, the false-twist processing line of thread by which false-twist processing was carried out, a knitting DE knitting processing line of thread, an air processing processing line of thread, etc. are used, for example.

[0009] In this invention, the fineness of a non-conducting synthetic fiber is less than 5 deniers. If fineness exceeds 5 deniers, the hand of the obtained knitting fabric serves as rough **, and is not desirable. Moreover, the hot water contraction of a non-conducting synthetic fiber is 15% or less. Since knitting fabric causes high contraction since it is put on the bottom of an elevated temperature, and a wrinkle occurs on a knitting fabric front face or it is hard coming to obtain the thing of a desired property in giving dyeing and finishing etc. to the composed knitting fabric, if a hot water contraction exceeds 15%, it is not desirable. Moreover, since there is a possibility that the conductive fiber made to be located inside by a hot water contraction becoming large too much compared with conductive fiber by the volume on **** may be exposed to a knitting fabric front face when the hot water contraction of a non-conducting synthetic fiber exceeds 15%, it is not desirable. Here, the measuring method of a hot water contraction is as follows. That is, 1 ** of fiber is fixed, 1/10 (g/d) of preliminary tensions are given to the other end, 500mm is measured correctly, and the mark is put on two points. Then, after

taking a preliminary tension and being immersed for 30 minutes into a boiling water, it takes out, water is lightly cut with a blotting paper or cloth, and it air-dries in the level state. Then, a preliminary tension is hung again and length lmm for the two aforementioned points is planned. lmm of a more than is measured 10 times each, and a contraction is computed by formula $[(500-l)/500] \times 100$, and let the average be a hot water contraction (%).

[0010] As for B line of thread used for this invention, a hot water contraction consists [fineness] of 10% or less of conductive fiber by less than 15 deniers. As conductive fiber, various kinds of well-known things can be used conventionally, for example, a conductive particle is contained in a metal fiber, a carbon fiber, the thermoplastic fiber containing a conductive particle, and a core part, and the sheath-core type compound thermoplasticity fiber which does not contain a conductive particle can be used for the sheath section. Generally the electric resistance value of these conductive fiber is 1×10^9 or less ohm/cm. Also as this B line of thread, a multifilament line of thread, a spinning line of thread, etc. are used. Moreover, as a form of a multifilament line of thread, like A line of thread, although a well-known form is used conventionally, the false-twist processing line of thread by which false-twist processing was carried out, a knitting DE knitting processing line of thread, an air processing processing line of thread, etc. are used, for example.

[0011] The fineness of conductive fiber is less than 15 deniers. Since the conductive fiber which should be located inside will jump out outside or the hand of the obtained knitting fabric will serve as rough ** in case it composes of the volume on **** if fineness exceeds 15 deniers, it is not desirable. Moreover, the hot water contraction of conductive fiber is 10% or less. Since knitting fabric causes high contraction since it is put on the bottom of an elevated temperature, and a wrinkle occurs on a knitting fabric front face or it is hard coming to obtain the thing of a desired property in giving dyeing and finishing etc. to the composed knitting fabric, if a hot water contraction exceeds 10%, it is not desirable. In addition, the measuring method of the hot water contraction of conductive fiber is also the same as the measuring method of the hot water contraction of said non-conducting synthetic fiber.

[0012] Next, it composes of the volume on **** so that A line of thread may serve as a side front and B line of thread may serve as a background (inside of the stitch by A line of thread) using said A line of thread and B line of thread. By composing of the volume on ****, A line of thread is arranged uniformly at a side front, and B line of thread is arranged uniformly at a background. In order to compose of the volume on **** concretely, A line of thread and B line of thread are arranged regularly separately, and the close angle of the line of thread to the tension and the knitting needle of a line of thread is made uniform, and is performed to 2 hole feeder of a knitting machine. The organization of mock RODI [which combined double-sided editing and the plain stitch], MOKKUMI llano rib, MIRANORIBU, double pique, and tuck reversible-as organization edited by **** ** is used suitably. In addition, as for B line of thread, it is desirable to carry out yarn feeding to a plain-stitch part.

[0013] The concrete method edited by **** is performed using the feeder shown in drawing 2. In drawing 2, 1 and 2 show the yarn feeding line of thread, and alpha and beta show the yarn feeding hole. What is necessary is to use B line of thread inside the front face of knitting fabric, to use B line of thread for a ***** case 1, to carry out yarn feeding to the yarn feeding hole beta, to use A line of thread for 2, and just to carry out yarn feeding to the yarn feeding hole alpha. Moreover, what is necessary is to use B line of thread inside the rear face of knitting fabric, to use A line of thread for a ***** case 1, to carry out yarn feeding to the yarn feeding hole beta, to use B line of thread for 2, and just to carry out yarn feeding to the yarn feeding hole alpha. Moreover, as an organization edited by ** edited by ****, the organization which showed drawing 1 is employable, for example. Drawing 1 expresses a stitch typically and a real line part is [the dashed line section] B line of thread in A line of thread. Among drawing 1, the volume on **** is used for 2F and 7F, and yarn feeding of the B line of thread is carried out.

[0014] Since A line of thread becomes reversal arises and is hard to be arranged at a side front uniformly when A line of thread and B line of thread are only lengthened, are arranged and are composed, without composing of the volume on **** like this invention, it is not desirable. Moreover, although using it for the portion which is tubercular in the front reverse side of knitting fabric by the volume on both tucks,

using B line of thread independently, and adopting how B line of thread does not appear in the side front of knitting fabric by the method of inserting into knitting fabric with the ***** method or an inlaid method inside knitting fabric etc. was also considered, as compared with the case where the volume on **** is adopted in any case, B line of thread was what is easy to jump out to the side front of knitting fabric. That is, where knitting fabric is composed in these cases, B line of thread which B line of thread turns into from conductive fiber in knitting fabric when **** rare ***** passes through a dyeing-and-finishing process jumps out on a knitting fabric front face. On the other hand, in order that B line of thread may not have a junction with knitting fabric in that the joint of B line of thread is only a tuck point, and, as for this reason, the remaining sinker loop portion tends to move it in the lump edited by the twist at the volume on both tucks, and ***** by the inlaid method, it is because it is easy to move B line of thread. On the other hand, if B line of thread is arranged inside the stitch of A line of thread by the volume on ****, it will be in the state where B line of thread was covered by A line of thread, and will be hard to move B line of thread, and B line of thread will stop easily being able to jump out to the side front of knitting fabric.

[0015] In case knitting fabric is composed by the volume on ****, it is made for A line of thread to become 60 - 99.8 % of the weight, and is made, as for the weight rate of both lines of thread, for B line of thread to become 0.2 - 40 % of the weight. If the weight rate of A line of thread becomes less than 60% of the weight, reversal arises in the case of the volume on ****, or **** arises, and desired knitting fabric is hard coming to obtain and is not desirable. If the weight rate of A line of thread exceeds 99.8 % of the weight, since a good antielectricity characteristic will no longer be acquired, it is not desirable. On the other hand, since the knitting fabric obtained will serve as a gray system and it will be hard coming to realize a desired hue when a hand becomes rough ** or adopts what was colored black etc. as conductive fiber, since the rigid rate of conductive large fiber becomes high comparatively if the weight rate of B line of thread exceeds 40 % of the weight, it is not desirable. Since it becomes impossible to give a good antielectricity characteristic when the weight rate of B line of thread becomes less than 0.2% of the weight, it is not desirable.

[0016] In many cases, well-known dyeing and finishing is conventionally given to the knitting fabric obtained by the method mentioned above. Since knitting fabric is put on the bottom of an elevated temperature in the case of this dyeing and finishing, it contracts. In this invention, since the hot water contraction of the non-conducting synthetic fiber which constitutes A line of thread is 15% or less and the hot water contraction of the conductive fiber which constitutes B line of thread has become 10% or less, it can prevent that B line of thread jumps out on the surface of knitting fabric by contraction of A line of thread. Therefore, it sets to this invention, even if it gives dyeing and finishing under an elevated temperature, a problem does not arise at all, and even if it heats specially and carries out contraction processing, it does not interfere.

[0017] Moreover, water repellent finishing is performed to knitting fabric. Water repellent finishing may be performed simultaneously with dyeing and finishing, when dyeing and finishing, and you may perform it separately (for example, after dyeing and finishing). Moreover, when performing contraction processing, you may carry out simultaneously with this contraction processing, and may carry out separately (for example, after contraction processing). This water repellent finishing is conventionally performed using a well-known water repellent. That is, pilus JINYUUMU salt system water repellents, such as the silicone system water repellent and steer lamination DOMECHIRUPIRIJINYUUMU chloride which made the principal component the fluorine system water repellent and dimethylpolysiloxane which made a polytetrafluoroethylene, perfluoro-octyl acrylate, etc. the principal component, methyl hydroxy SHIROSAN, etc., and octadecyl oxymethyl PIRIJINYUUMU chloride, an ethylene urea system water repellent, etc. can be used. If the fluorine system water repellent which made a polytetrafluoroethylene, perfluoro-octyl acrylate, etc. the principal component especially is used also in this, since good water repellence will be acquired, it is desirable.

[0018] Water repellent finishing is performed by giving the solvent solution made to distribute or dissolve a water repellent in solvents, such as solution which distributed or dissolved the water repellent in water, or a perchloroethylene, generally to knitting fabric. It is desirable to use the good thing of

permeability to a non-conducting synthetic fiber or conductive fiber as this solution and solvent solution. When solution is used especially, it is desirable to add in solution the penetrating agent to which water repellence, such as isopropyl alcohol, is not reduced. As a method of giving solution and a solvent solution, the known padding method, known dip coating, etc. are employable. When the padding method is adopted, in order to improve osmosis of the water repellent in solution or a solvent solution, it is desirable to carry out by methods, such as 2 nips and 2 DIP. The coating weight of the water repellent to knitting fabric has about 0.5 - 10 desirable % of the weight to a knitting fabric weight. The coating weight of a water repellent serves as the inclination for good water repellence to be hard to be acquired, at 0.5 or less % of the weight. On the contrary, it becomes [water-repellent improvement will be in a saturation state, and / cannot desire the further water-repellent improvement but / a water repellent] useless and is uneconomical even if the coating weight of a water repellent exceeds 10 % of the weight. [0019] The knitting fabric which has simulataneously a highly efficient water-repellent and highly efficient antielectricity characteristic as mentioned above can be obtained. Hereafter, based on an example, it explains still in detail.

[Example]

As an example A line of thread, the false-twist processing line of thread of 75 deniers of polyester multifilaments and 36 filament was prepared. The fineness of the single-yarn filament which constitutes this multifilament was 2.0 deniers, and the hot water contraction was 6%. 25 deniers of multifilaments and 2 filament which consists of a conductive sheath-core type bicomponent fiber which consists of a core part explained below and the sheath section as a B line of thread was prepared. The fineness of the single-yarn filament which constitutes this multifilament was 12.5 deniers, and the hot water contraction was 8%. It comes uniformly to mix the particle 65 weight section with a particle size of 0.2micro which coated the titanium-dioxide particle with the tin of specific resistance 5 ohm-cm, and intrinsic viscosity 0.87 and the polybutylene-terephthalate 35 weight section of 235 degrees C of melting points, and the core part of a conductive sheath-core type bicomponent fiber is constituted. On the other hand, in the copolymer of the intrinsic viscosity 0.71 to which it comes to carry out copolymerization of the ethylene terephthalate 1 weight section and the ethylene isophthalate 9 weight section, 231 degrees C of melting points, and 65 degrees C of glass transition points, the sheath section of a conductive sheath-core type bicomponent fiber made the titanium-dioxide pigment contain 7.5% of the weight, and is constituted.

[0020] Yarn feeding was carried out using aforementioned A line of thread and aforementioned B line of thread by the yarn feeding method which is ***** shown in drawing 1 , and is shown below, and knitting fabric was composed. That is, yarn feeding only of the A line of thread was carried out to 1F, 3F, 4F, 5F, 6F, 8F, 9F, and 10F. On the other hand, by the feeder which shows A line of thread and B line of thread to drawing 2 , A line of thread was used for 1, yarn feeding was carried out to the yarn feeding hole beta, B line of thread was used for 2, and yarn feeding was carried out to 2F and 7F in the yarn feeding hole alpha. Knitting fabric was composed of the yarn feeding method like a not less by the volume on ****. The above organization is double-knit machine LPJ-H made from the Fukuhara energy machine. Type is used and it is furnace diameter 33" and gage 28G. It composed. In this case, the physical relationship of B line of thread in knitting fabric serves as the inside of A line-of-thread stitch of the background of knitting fabric, and since yarn feeding is carried out to the pan 2F and 7F, it serves as uniform arrangement of the shape of a child of a deer. In addition, A line of thread was 95 % of the weight, and B line of thread of the weight ratio in the knitting fabric of A line of thread and B line of thread was 5 % of the weight.

[0021] Thus, the obtained knitting fabric was dyed by the dyeing-and-finishing method used regularly, and water repellent finishing was performed by the following methods after rinsing and dryness. That is, it was immersed in the water bath of Asahi guard AG710 (Asahi glass incorporated company make, fluorine system water repellent) 60 g/l and isopropyl alcohol 50 g/l, and by 2 nips and the 2 dipping method, to the fiber weight, the Asahi guard AG710 was given 2% of the weight, and it dried. The obtained antielectricity characteristic hydrofuge knitting fabric was eyes 450 g/m by width of 160cm. Moreover, as shown in Table 1, this antielectricity characteristic hydrofuge knitting fabric has the outstanding antielectricity characteristic, and was rich in water repellence.

[0022] It replaced with A line of thread and B line of thread, and except having carried out yarn feeding of the false-twist processing line of thread of 100 deniers of polyester multifilaments, and 36 filament by the usual method, knitting fabric was composed to 2F and 7F which carried out **** yarn feeding of A line of thread and the B line of thread in the example example of comparison by the same method as an example, and dyeing and finishing and water repellent finishing were performed to them. The obtained water-repellent knitting fabric was 450g [/m] eyes by width of 160cm. Although they were approximated with the antielectricity characteristic hydrofuge knitting fabric concerning an example, the hand of water-repellent knitting fabric and water repellence were a thing inferior to an antielectricity characteristic as they were shown in Table 1.

[0023]

[Table 1]

			実施例	比較例
制電性能	帯電電荷量 ¹⁾	HL ⁴⁾ -5	◎	×
	表面漏洩抵抗 ²⁾	HL-0	◎	○
		HL-50	◎	×
		HL-100	◎	×
	アッシュテスト ³⁾	HL-0	◎	○
		HL-50	◎	×
		HL-100	◎	×
	撥水性能 ⁵⁾	HL-0	1 0 0	1 0 0
		HL-50	9 0	9 0
		HL-100	8 5	8 5

[0024] The evaluation method of each item in Table 1, the measuring method, etc. are as follows.

1) The amount of electrification charges : the amount of electrification charges was measured by the tumbler method (JIS T-8118). That is, after supplying the sample to the tumbler dryer which stuck the cheesecloth for friction all over the inside and operating for 60 degree-Cx 15 minutes, the glove made from polyethylene was worn on the finger, the sample was taken out, it supplied to the Faraday cylinder, and the potential of a Faraday cylinder was measured. The amount of electrification charges was computed by the following formula from this potential. That is, it is amount of electrification charges (coulomb) =[capacitor capacity (farad)] x [potential (bolt)]. And the amount of electrification charges was ranked as three stages, and it considered as O, O, and x at order with few amounts of electrification charges.

2) Surface-leakage resistance : surface-leakage resistance grasped the ends of the length direction of a strip-of-paper-like sample by the electrode (a grasping interval is 1.5cm), and asked for surface-leakage resistance by the following formula. That is, they are surface-leakage resistance = measurement current. However, measurement voltage was set to 500V in principle. And the value of surface-leakage resistance was ranked as three stages, and it considered as O, O, and x at order with little surface-leakage resistance.

3) Ash test : an ash test brings a sample close on 4.5cm of the ashes of tobacco, after rubbing the cheesecloth for friction, and a sample strongly ten round trips. And ashy coating weight was ranked as three stages, and it considered as O, O, and x at order with little coating weight.

4) HL:HL expresses the number of times of wash, and they are the sample which performed one hot water rinsing further and carried out gas conditioning after dryness after washing a sample [HL-0] without wash, and HL-5 5 times by the JISL-0217 103 method, and the sample after HL-50 wash 50 times wash and HL-100 100 times similarly.

5) A water-repellent performance : a water-repellent performance is the value measured according to the

spray method (JIS L-1018).

[0025]

[Effect of the Invention] The antielectricity characteristic hydrofuge knitting fabric obtained by the method concerning this invention explained above Since you make it the stitch of B line of thread which consists of conductive fiber located inside the stitch of A line of thread which consists of a non-conducting synthetic fiber currently generally used and it is made to appear a uniform feeling of a front face, It seems to consist of A lines of thread which the whole knitting fabric becomes from the non-conducting synthetic fiber currently generally used, the gray or the black fault which the conductive fiber which constitutes B line of thread has is compensated, and the effect that it can prevent that the appearance of knitting fabric is spoiled is done so. When knitting fabric is especially dyed and finished to a light color system hue, the gray or black which conductive fiber has cannot appear easily in a front face, and does so the effect that the appearance of knitting fabric is hard to be spoiled.

[0026] Moreover, in order to locate the stitch of A line of thread in a side front, and for the method concerning this invention to give a water repellent to the knitting fabric in which B line of thread is made to be located by the inside of this stitch and to perform water repellent finishing, a water repellent tends to adhere uniformly on the surface of knitting fabric, and the effect that knitting fabric with surface homogeneous water repellence can be obtained is done so. It is because a water repellent adheres to A line of thread which forms the knitting fabric front face uniformly even if it is the case where B line of thread to which a water repellent cannot adhere easily is used, since A line of thread is uniformly exposed, without B line of thread being hardly exposed on the surface of knitting fabric. Moreover, since A line of thread is uniformly exposed, without B line of thread being hardly exposed to a knitting fabric front face even if it is the case where bad B line of thread of a hand is used, it can prevent that the hand on the front face of knitting fabric falls.

[0027] Therefore, according to this invention, the semipermanent antielectricity characteristic by conductive fiber and surface water repellence have simulataneously the good water repellence of being homogeneously highly efficient, and the effect that the good antielectricity characteristic hydrofuge knitting fabric of a hand can be obtained is done so. Therefore, if the antielectricity characteristic hydrofuge knitting fabric obtained by the method concerning this invention is used as a sheet for old men etc., leakage prevention of urine and prevention of static electricity frequently generated in a dry period can be aimed at, and it can be used suitably.

[Translation done.]

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L1 ANSWER 1 OF 1 WPINDEX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 1995-261794 [34] WPINDEX

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TI Prepn. of knitted fabric having water repellency and antistaticity - by
knitting fabric composed of yarn made from conductive and non-conductive
synthetic fibres and adding water repellent.

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Prepn. of (F) a knitted fabric comprising knitting (F1) a fabric composed
of (F11) a specified yarn in right side surface of (F1) and (F12) another
specified yarn in back surface of (F1) by means of a plating stitch and
adding (F2) a water-repelling agent onto the knitted fabric (F11). Yarn is
made of 60.0-99.8 wt.% non-conductive synthetic fibre having shrinkage in
boiling water of greater than 15% and fineness of 5 denier and (F12) yarn
is made of 0.2-40.0 wt.% conductive synthetic fibre of shrinkage in
boiling water of less than 10% and fineness of greater than 5 denier.

USE - The fabric is useful for making clothes.

ADVANTAGE - The fabric has improved and durable water repellency and
antistaticity simultaneously, and has good appearance too, driven from
covering the black or grey conductive synthetic fibre in back of the
knitted fabric.

Dwg.0/2

FS CPI

FA AB

MC CPI: F02-B02; F02-B03; F03-C02A; F03-C05; F04-C

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(54)【発明の名称】 制電性撥水編地の製造方法

(57)【要約】

【目的】 外観が良好で、撥水性能に優れた制電性撥水編地を提供する。

【構成】 織度が5デニール未満で且つ熱水収縮率が15%以下の非導電性合成繊維よりなる糸条（以下、「A糸条」と言う。）を準備する。一方、織度が15デニール未満で熱水収縮率が10%以下の導電性繊維よりなる糸条（以下、「B糸条」と言う。）を準備する。両糸条を使用し、添糸編によってA糸条を表側に位置せしめ、B糸条を裏側に位置せしめるようにして製編する。この際、A糸条の重量割合は60.0～99.8重量%で、B糸条の重量割合は0.2～40.0重量%となるようにする。この得られた編地に、例えば染色加工すると共に、撥水剤を付与する。

【効果】 灰色あるいは黒色である導電性繊維が、A糸条の内側に配置せしめられているので、得られる編地表面の外観が損なわれにくく、撥水剤も表面に均質に付与される。また、導電性繊維による半永久的な制電性も付与しうる。

【特許請求の範囲】

【請求項1】 織度が5デニール未満で且つ熱水収縮率が15%以下の非導電性合成繊維よりなる糸条（以下、「A糸条」と言う。）と、織度が15デニール未満で熱水収縮率が10%以下の導電性繊維よりなる糸条（以下、「B糸条」と言う。）とを用い、添糸編によってA糸条を表側に位置せしめ、B糸条を裏側に位置せしめるようにし、且つA糸条の重量割合が60.0～99.8重量%でB糸条の重量割合が0.2～40.0重量%となるようにして製編し、得られた編地に撥水剤を付与することを特徴とする制電性撥水編地の製造方法。

【発明の詳細な説明】**【0001】**

【産業上の利用分野】 本発明は、衣料用あるいは衣料資材用として好適に使用しうる制電性撥水編地の製造方法に関し、特に良好な制電性と撥水性とを併有する制電性撥水編地の製造方法に関するものである。

【0002】

【従来の技術】 合成繊維を用いて製編された編地は、繊維相互間の摩擦による静電気障害が生じやすい。このため、編地の染色加工時に帯電防止剤を付与する方法が常用されている。しかしながら、この方法による帯電防止効果は永久的なものではなく、一般的に繰り返し洗濯によってその性能低下をきたし、30回程度の繰り返し洗濯を実施すると、繊維に付着している帯電防止剤が脱落し、その帯電防止効果は消失する。一方、合成繊維を用いた編地に撥水性を付与するためには、一般的に染色加工工程における最終仕上工程で、弗素系やシリコン系等の撥水剤を編地に付与し、乾燥熱処理することが行われている。

【0003】 このように、染色加工工程で行われる、いわゆる後加工品の帯電防止加工と撥水加工とは、その目的に応じて通常各々単独で行われ、両者を同時に行って帯電防止性（制電性）と撥水性とを併有させることは、一般的には行われていない。これは、帯電防止性の効果を高めるためには、編地表面の吸湿性が良好でなければならず、撥水加工を施すと、この吸湿性が低下するからである。即ち、帯電防止剤と撥水剤とを使用することによって、制電性と撥水性とを併有させた編地は、実用化されるに到っていないのである。

【0004】 このため、帯電防止剤を使用せずに、導電性繊維を使用し、これを少量混入させた編地に、染色加工工程で撥水剤を付与する方法が提案されている。この方法によれば、高性能の制電性と撥水性とを併有する編地が得られると考えられる。何故なら、帯電防止剤に代えて導電性繊維を使用しているため、繰り返し洗濯による帯電防止剤の脱落ということがなく、高性能の制電性を発揮しうるからである。また、導電性繊維を使用しているため、編地表面の性状とは無関係に、即ち編地表面が撥水性であっても、良好な制電性を発揮するからであ

る。

【0005】 しかしながら、導電性繊維は、一般に炭素微粒子やカーボンブラック微粒子を繊維中に練り込んだものであり、灰色あるいは黒色に着色しているため、他繊維と混織したり若しくは他糸条と交編すると、導電性繊維自身の着色によって、すじ状あるいは杢調の模様が編地に現われ、外観を損なうという欠点があった。また、導電性繊維に対する撥水剤の付着は、他の一般の合成繊維に対する撥水剤の付着に比べて、付着しにくかったりあるいは付着しても脱落しやすいということがあった。従って、編地表面の撥水性が不均一になり、全体に亘って良好な撥水性を実現しにくいという欠点もあった。更に、導電性繊維の織度は、一般に用いられる合成繊維よりも太織度であるため、合成繊維と混織したりあるいは合成繊維糸条と交編したりすると、得られる編地の風合が低下するという欠点もあった。

【0006】

【発明が解決しようとする課題】 そこで、本発明は、一般に使用されている非導電性合成繊維よりなる糸条と導電性繊維よりなる糸条とを使用し、添糸編によって編地を編成することによって、導電性繊維よりなる糸条を編目の内側に位置せしめ、導電性繊維が編地表面に露出するのを防止し、もって導電性繊維の着色によって外観が損なわれるのを防止すると共に、編地表面における撥水剤の付着性の低下を防止し、更に編地表面の風合の低下を防止しながら、高性能の撥水性及び高性能の制電性を併有する編地を提供しようというものである。

【0007】

【課題を解決するための手段】 即ち、本発明は、織度が5デニール未満で且つ熱水収縮率が15%以下の非導電性合成繊維よりなる糸条（以下、「A糸条」と言う。）と、織度が15デニール未満で熱水収縮率が10%以下の導電性繊維よりなる糸条（以下、「B糸条」と言う。）とを用い、添糸編によってA糸条を表側に位置せしめ、B糸条を裏側に位置せしめるようにし、且つA糸条の重量割合が60.0～99.8重量%でB糸条の重量割合が0.2～40.0重量%となるようにして製編し、得られた編地に撥水剤を付与することを特徴とする制電性撥水編地の製造方法に関するものである。

【0008】 本発明で用いるA糸条は、織度5デニール未満で熱水収縮率が15%以下の非導電性合成繊維よりなる糸条である。非導電性合成繊維としては、従来衣料用等に一般に使用されている、ポリエステル繊維、ポリアミド繊維、ポリオレフィン系繊維、ポリアクリロニトリル繊維等が使用される。即ち、本発明で言う非導電性合成繊維というのは、もう一方の繊維である導電性繊維と区別するために用いられているものにすぎず、従来から衣料用等として常用されている合成繊維のことを意味しているにすぎない。また、糸条としては、マルチフィラメント糸条や紡績糸条等が使用される。特に、マルチフィ

ラメント糸条の形態としては、従来公知の形態が使用されるが、例えば、仮撚加工された仮撚加工糸条、ニット・デ・ニット加工糸条、エアー処理加工糸条等が用いられる。

【0009】本発明において、非導電性合成繊維の繊度は5デニール未満である。繊度が5デニールを超えると、得られた編地の風合が粗硬となり、好ましくない。また、非導電性合成繊維の熱水収縮率は15%以下である。熱水収縮率が15%を超えると、編成された編地に染色加工等を施す場合には、高温下に置かれるため編地が高収縮を起こし、編地表面に皺が発生したり、あるいは所望の性質のものが得にくくなるため、好ましくない。また、非導電性合成繊維の熱水収縮率が15%を超えると、導電性繊維に比べて熱水収縮率が大きくなりすぎ、添糸編によって内側に位置せしめられた導電性繊維が、編地表面に露出してくる恐れがあるため、好ましくない。ここで、熱水収縮率の測定方法は以下のとおりである。即ち、繊維の一旦を固定し、他端に1/10(g/d)の初荷重を与え、正しく500mmを計って2点に印を付ける。この後、初荷重をとって沸騰水中に30分間浸漬した後、取り出して軽く吸取紙又は布で水を切り、水平状態で自然乾燥する。その後、再び初荷重を掛けて前記2点間の長さ1mmを図る。以上の1mmの測定を各10回行い、そして式
$$\left[\frac{(500 - 1)}{500} \right] \times 100$$
で収縮率を算出し、その平均値を熱水収縮率(%)とする。

【0010】本発明に用いるB糸条は、繊度が15デニール未満で熱水収縮率が10%以下の導電性繊維よりなるものである。導電性繊維としては、従来公知の各種のものを使用することができ、例えば、金属繊維、炭素繊維、導電性微粒子を含有する熱可塑性繊維、芯部に導電性微粒子を含有し鞘部には導電性微粒子を含有しない芯鞘型複合熱可塑性繊維等を使用することができる。これらの導電性繊維の電気抵抗値は、一般的に $1 \times 10^9 \Omega / \text{cm}$ 以下である。このB糸条としても、マルチフィラメント糸条や紡績糸条等が使用される。また、マルチフィラメント糸条の形態としては、A糸条と同様に、従来公知の形態が使用されるが、例えば、仮撚加工された仮撚加工糸条、ニット・デ・ニット加工糸条、エアー処理加工糸条等が用いられる。

【0011】導電性繊維の繊度は15デニール未満である。繊度が15デニールを超えると、添糸編で編成する際に、内側に位置すべき導電性繊維が外側に飛び出したり、あるいは得られた編地の風合が粗硬となるため、好ましくない。また、導電性繊維の熱水収縮率は10%以下である。熱水収縮率が10%を超えると、編成された編地に染色加工等を施す場合には、高温下に置かれるため編地が高収縮を起こし、編地表面に皺が発生したり、あるいは所望の性質のものが得にくくなるため、好ましくない。なお、導電性繊維の熱水収縮率の測定方法も、前記した非導電性合成繊維の熱水収縮率の測定方法と同一で

ある。

【0012】次に、前記したA糸条とB糸条とを用い、A糸条が表側となり、B糸条が裏側（A糸条による編目の内側）となるように添糸編で編成する。添糸編で編成することにより、A糸条が均一に表側に配置され、B糸条が均一に裏側に配置されるのである。具体的に添糸編で編成するには、編機の2穴給糸口にA糸条とB糸条とを別個に規則正しく配列し、糸条の張力や編針に対する糸条の入角度を均一に行なう。添糸編の組織としては、両面編と平編を組み合わせたモックロディー、モックミラノリブ、ミラノリブ、ダブルピッケ、タックリバーシブル等の組織が好適に用いられる。なお、B糸条は平編部位に給糸するのが好ましい。

【0013】添糸編の具体的方法は、例えば、図2に示した給糸口を使用して行われる。図2において、1、2は給糸糸条を示しており、 α 、 β は給糸穴を示している。B糸条を編地の表面の内側に編込む場合には、1にB糸条を用いて給糸穴 β に給糸し、2にA糸条を用いて給糸穴 α に給糸すればよい。また、B糸条を編地の裏面の内側に編込む場合には、1にA糸条を用いて給糸穴 β に給糸し、2にB糸条を用いて給糸穴 α に給糸すればよい。また、添糸編の製編組織としては、例えば、図1に示した組織を採用することができる。図1は、編目を模式的に表わしたものであり、実線部がA糸条で破線部がB糸条である。図1中、2F、7Fに添糸編を用いてB糸条を給糸している。

【0014】本発明の如く添糸編で編成せずに、A糸条とB糸条とを単に引き揃えて編成した場合には、反転現象が生じ、A糸条が均一に表側に配置されにくくなるので、好ましくない。また、B糸条を単独に用いて、両タック編で編地の表裏を結節する部分に使用して、編地の内側に編込む方法、あるいはインレイ方式により編地の中に挿入する方法等によって、B糸条が編地の表側に現われない方法を採用することも考えられるが、いずれの場合も添糸編を採用した場合に比較して、B糸条が編地の表側に飛び出しやすいものであった。即ち、これらの場合には、編地を編成した状態では、B糸条が編地内に編込まれているが、染色加工工程を経たときには、導電性繊維よりなるB糸条が編地表面に飛び出してくるのである。この理由は、両タック編により編込みにおいては、B糸条の結合点はタック点だけで、残りのシンカーループ部分が動きやすいこと、一方インレイ方式による編込みにおいても、B糸条は編地との接合点が全く無いため、B糸条が動きやすいことによる。これに対して、B糸条が添糸編によってA糸条の編目の内側に配置されていると、A糸条によってB糸条が覆われた状態となり、B糸条が動きにくく、B糸条が編地の表側に飛び出しにくくなるのである。

【0015】添糸編によって編地を編成する際、両糸条の重量割合は、A糸条が60～99.8重量%となるように

し、B糸条が0.2~40重量%となるようにする。A糸条の重量割合が60重量%未満になると、添糸編の際に反転現象が生じたり、あるいは編疵が生じたりして、所望の編地が得にくくなり好ましくない。A糸条の重量割合が99.8重量%を超えると、良好なる制電性が得られなくなるため、好ましくない。一方、B糸条の重量割合が40重量%を超えると、比較的剛性の大きい導電性繊維の割合が高くなるため、風合が粗硬となったり、あるいは導電性繊維として黒色等に着色されたものを採用した場合、得られる編地が灰色系となって、所望の色相を実現しにくくなるため、好ましくない。B糸条の重量割合が0.2重量%未満になると、良好な制電性を付与できなくなるため、好ましくない。

【0016】前述した方法で得られた編地には、多くの場合、従来公知の染色加工が施される。この染色加工の際、編地は高温下に置かれるため、収縮する。本発明においては、A糸条を構成する非導電性合成繊維の熱水収縮率が15%以下となっており、またB糸条を構成する導電性繊維の熱水収縮率が10%以下となっているため、A糸条の収縮によってB糸条が編地の表面に飛び出すのを防止することができる。従って、本発明においては、高温下における染色加工を施しても何ら問題が生じないし、また特別に加熱して収縮処理しても差し支えない。

【0017】また、編地には撥水加工が施される。撥水加工は、染色加工を行うときには染色加工と同時に進めてもよいし、別個に（例えば、染色加工後に）行ってもよい。また、収縮処理を施すときには、この収縮処理と同時に進めてもよいし、別個に（例えば、収縮処理後に）行ってもよい。この撥水加工は、従来公知の撥水剤を使用して行われる。即ち、ポリテトラフルオロエチレンやペルフルオロオクチルアクリレート等を主成分とした弗素系撥水剤、ジメチルポリシロキサンやメチルヒドロキシシロサン等を主成分としたシリコン系撥水剤、ステアラミドメチルピリジニウムクロライドやオクタデシルオキシメチルピリジニウムクロライド等のピリジニウム塩系撥水剤、エチレン尿素系撥水剤等を使用することができる。この中でも、特にポリテトラフルオロエチレンやペルフルオロオクチルアクリレート等を主成分とした弗素系撥水剤を使用すると、良好な撥水性が得られるので好ましい。

【0018】撥水加工は、一般的に、水に撥水剤を分散若しくは溶解させた水溶液、又はパークロルエチレン等の溶剤に撥水剤を分散若しくは溶解させた溶剤溶液を、編地に付与することによって行われる。この水溶液や溶剤溶液としては、非導電性合成繊維や導電性繊維に対して浸透性の良好なものを使用するのが好ましい。特に、水溶液を使用した場合には、イソプロピルアルコール等の撥水性を低下させない浸透剤を、水溶液中に添加するのが好ましい。水溶液や溶剤溶液を付与する方法としては、既知のパディング法や浸漬法等を採用することが

できる。パディング法を採用した場合には、水溶液や溶剤溶液中の撥水剤の浸透を良くするため、2ニップ・2ディップ等の方法で行うのが好ましい。編地に対する撥水剤の付着量は、編地重量に対して0.5~10重量%程度が好ましい。撥水剤の付着量が0.5重量%以下では、良好な撥水性が得られにくい傾向となる。逆に、撥水剤の付着量が10重量%を超えても、撥水性の向上が飽和状態となって、更なる撥水性の向上が望めず、撥水剤が無駄となって不経済である。

【0019】以上のようにして、高性能の撥水性及び高性能の制電性を併有する編地を得ることができるのである。以下、更に詳細に、実施例に基づいて説明する。

【実施例】

実施例

A糸条として、ポリエステルマルチフィラメント75デニール/36フィラメントの仮撚加工糸条を準備した。このマルチフィラメントを構成する単糸フィラメントの繊度は2.0デニールであり、熱水収縮率は6%であった。B糸条として、以下に説明する芯部と鞘部とで構成されている導電性芯鞘型複合繊維よりなるマルチフィラメント25デニール/2フィラメントを準備した。このマルチフィラメントを構成する単糸フィラメントの繊度は12.5デニールであり、熱水収縮率は8%であった。導電性芯鞘型複合繊維の芯部は、二酸化チタン粒子に比抵抗 $5\Omega\cdot\text{cm}$ の酸化第二錫をコーティングした粒径 0.2μ の粒子65重量部と、固有粘度0.87及び融点 235°C のポリブチレンテレフタレート35重量部とが均一に混合されてなるもので構成されている。一方、導電性芯鞘型複合繊維の鞘部は、エチレンテレフタレート1重量部とエチレンイソフタレート9重量部とが共重合されてなる、固有粘度0.71、融点 231°C 及びガラス転移点 65°C の共重合体中に二酸化チタン顔料を7.5重量%含有させたもので構成されている。

【0020】前記のA糸条とB糸条を用いて、図1に示す編組織で且つ以下に示す給糸法で給糸して編地を編成した。即ち、1F、3F、4F、5F、6F、8F、9F、10FにA糸条のみを給糸した。一方、2F及び7Fには、A糸条とB糸条を図2に示す給糸口により、1にA糸条を用いて給糸穴 β に給糸し、2にB糸条を用いて給糸穴 α に給糸した。以上の如き、給糸方法で添糸編によって編地を編成した。以上の編成は、福原精機製ダブルニット機LPJ-H型を用い、釜径33",ゲージ28Gで編成した。この場合、編地におけるB糸条の位置関係は、編地の裏側のA糸条編目の内側となり、さらに2Fと7Fに給糸しているため鹿の子状の均一な配置となる。なお、A糸条とB糸条の編地における重量比率は、A糸条が95重量%で、B糸条が5重量%であった。

【0021】このようにして得られた編地を、常用されている染色加工方法で染色し、水洗及び乾燥後、以下の方法で撥水加工を施した。即ち、アサヒガードAG710

(旭ガラス株式会社製、弗素系撥水剤) 60 g / 1、イソプロピルアルコール50 g / 1の水浴に浸漬し、2ニップ・2ディップ法にて、繊維重量に対しアサヒガードAG710を2重量%付与し乾燥した。得られた制電性撥水編地は、巾160cmで目付450 g / mであった。また、この制電性撥水編地は、表1に示したように、優れた制電性を有し、且つ撥水性に富んだものであった。

【0022】比較例

実施例においてA糸条とB糸条を添糸給糸した2F及び7Fに、A糸条及びB糸条に代えて、ポリエステルマルチフィラメント100デニール/36フィラメントの仮撚加工糸条を通常の方法で給糸した以外は、実施例と同様の方法で編地を編成し、染色加工及び撥水加工を行った。得られた撥水性編地の風合及び撥水性は、実施例に係る制電性撥水編地と近似したものであったが、表1に示したとおり、制電性に劣るものであった。

【0023】

【表1】

			実施例	比較例
制電性	帯電電荷量 ¹⁾	HL ⁴⁾ -5	◎	×
		HL-0	◎	○
	表面漏洩抵抗 ²⁾	HL-50	◎	×
		HL-100	◎	×
	アッシュテスト ³⁾	HL-0	◎	○
		HL-50	◎	×
		HL-100	◎	×
	撥水性能 ⁵⁾	HL-0	100	100
		HL-50	90	90
		HL-100	85	85

【0024】表1中の各項目の評価方法及び測定方法等は、以下のとおりである。

1) 帯電電荷量：帯電電荷量は、タンブラー法 (JIS T-8118) で測定した。即ち、摩擦用綿布を内面全面に張り付けたタンブラー乾燥機に試料を投入し、60℃×15分間運転した後、手指にポリエチレン製手袋を着用して試料を取り出し、ファラデーケージに投入し、ファラデーケージの電位を測定した。この電位から次式によって帯電電荷量を算出した。即ち、帯電電荷量 (クーロン) = [コンデンサー容量 (ファラッド)] × [電位 (ボルト)] である。そして、帯電電荷量を三段階にランク付けし、帯電電荷量の少ない順に、◎、○、×とした。

2) 表面漏洩抵抗：表面漏洩抵抗は、短冊状試料の長さ方向の両端を電極で把持し (把持間隔は1.5cm)、次式にて表面漏洩抵抗を求めた。即ち、表面漏洩抵抗 = 測定電圧 / 電流である。但し、測定電圧は原則として500Vとした。そして、表面漏洩抵抗の値を三段階にランク付け

し、表面漏洩抵抗の少ない順に、◎、○、×とした。

3) アッシュテスト：アッシュテストは、摩擦用綿布と試料を往復10回強く摩擦した後、タバコの灰の4.5cm上に試料を近づける。そして、灰の付着量を三段階にランク付けし、付着量の少ない順に、◎、○、×とした。

4) HL：HLは洗濯回数を表わすものであり、HL-0は洗濯なしの試料、HL-5はJISL-0217 103法で5回洗濯した後、更に湯洗1回を行って乾燥後、調湿した試料、同様にHL-50は50回洗濯、HL-100は100回洗濯した後の試料である。

5) 撥水性能：撥水性能は、スプレー法 (JIS L-1018) に準じて測定した値である。

【0025】

【発明の効果】以上説明した本発明に係る方法で得られた制電性撥水編地は、一般に使用されている非導電性合成繊維よりなるA糸条の編目の内側に、導電性繊維よりなるB糸条の編目を位置せしめ、均一なる表面感を現出させているため、編地全体があたかも一般に使用されている非導電性合成繊維よりなるA糸条で構成されているように見え、B糸条を構成している導電性繊維の持つ灰色あるいは黒色の欠点を補い、編地の外観が損なわれるのを防止できるという効果を奏する。特に、編地を淡色系色相に染色加工した場合においても、導電性繊維の持つ灰色あるいは黒色が表面に現われにくく、編地の外観が損なわれにくいという効果を奏する。

【0026】また、本発明に係る方法は、A糸条の編目が表側に位置し、B糸条がこの編目の内側に位置せしめられている編地に、撥水剤を付与して撥水加工を施すため、撥水剤が編地の表面に均一に付着しやすく、表面の撥水性が均質な編地を得ることができるという効果を奏する。何故なら、編地の表面にはB糸条が殆ど露出せず、A糸条が均一に露出しているため、撥水剤が付着しにくいB糸条を用いた場合であっても、編地表面を形成しているA糸条に均一に撥水剤が付着するからである。また、風合の悪いB糸条を用いた場合であっても、編地表面にはB糸条が殆ど露出せず、A糸条が均一に露出しているため、編地表面の風合が低下するのを防止しうる。

【0027】従って、本発明によれば、導電性繊維による半永久的な制電性と、表面の撥水性が均質で且つ高性能であるという良好な撥水性とを併有し、且つ風合の良好な制電性撥水編地を得ることができるという効果を奏する。依って、本発明に係る方法で得られた制電性撥水編地を、老人用シーツ等として使用すれば、尿の漏れ防止と乾燥期に度々発生する静電気の防止とを図ることができ、好適に使用することができるものである。

【図面の簡単な説明】

【図1】本発明に用いる編組織の一例を示す図である。

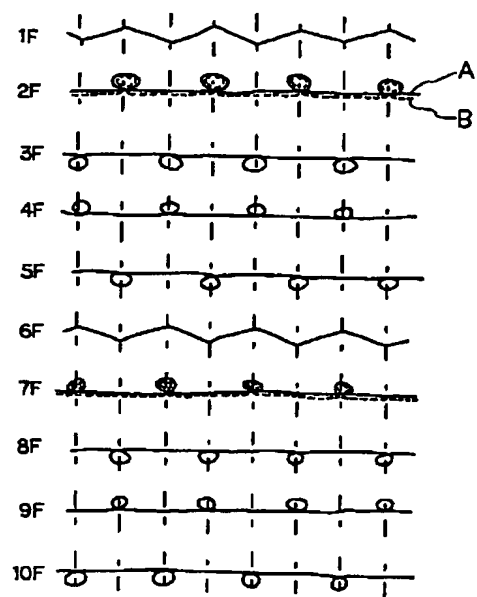
【図2】本発明に用いる編成法の一例を示した概略図である。

【符号の説明】

A A糸条

B B糸条

【図1】



【図2】

